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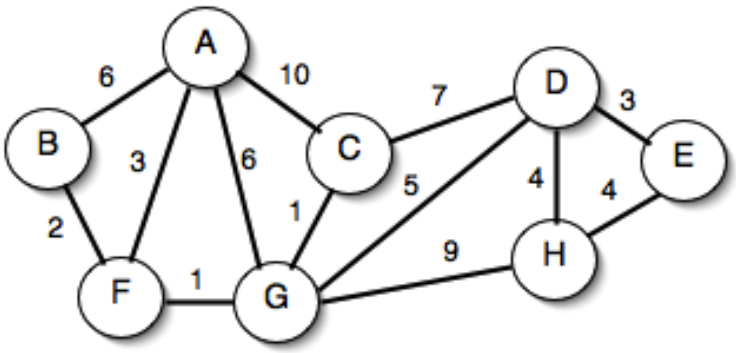
CSCI 3104, Algorithms **Profs. Chen & Grochow**

Quiz 7 Q2 S13 **Spring 2020, CU-Boulder**

Instructions: This quiz is open book and open note. You **may** post clarification questions to Piazza, with the understanding that you may not receive an answer in time and posting does count towards your time limit (30 min for 1x, 37.5 min for 1.5x, 45 min for 2x). Questions posted to Piazza **must be posted as PRIVATE QUESTIONS.** Other use of the internet, including searching for answers or posting to sites like Chegg, is strictly prohibited. Violations of these grounds to receive a 0 on this quiz. Proofs should be written in **complete sentences. Show and justify all work to receive full credit.**

Standard 13. Consider the following graph G.



We seek to construct a minimum spanning from G, using Prim's Algorithm with the B as the source vertex. At the first stage of Prim's Algorithm, we push (B, F) and (B, A) into our priority queue. The (B, F) edge is then our first edge selected for the MST.

Determine the next five edges selected to be included in the MST. Clearly articulate the steps Prim's Algorithm takes to select these edges.

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YOUR ANSWER HERE Our first edge selected for the MST will be (B, F).
(1). The next edge that Prim's algorithm will select is (F, G) for the MST. This is because Prim's algorithm will next check (F, G) and (F, A). Since (F, G) is the next safe edge. It is the next safe edge because vertex A is already in the queue and (F, G) has a lower weight.
(2). The next edge that Prim's algorithm will select is (G, C) for the MST. This is because Prim's algorithm will next check (G, A), (G, C), (G, D), and (G, H). All of (G, C), (G, D) and (G, H) are safe, but since (G, C) has the smallest weight, it is selected next by Prim's. D and H are then added to the queue.
(3). The next edge that Prim's algorithm will select is (F, A) for the MST. From C, all possible edges are unsafe, thus we choose the next safe edge with the least weight (connected with any of the vertexes in the queue). This happens to be the weight in edge (F, A). A is then removed from the queue.
(4). the next edge that Prim's algorithm will select is (G, D) for the MST. From A, all possible edges are unsafe, thus we choose the next safe edge with the least weight (connected with any of the vertexes in the queue). This happens to be the weightn in edge (G, D). D is then removed from the queue.
(5). The next edge that Prim's algorithm will select is (D, E) for the MST. Since edge (C, D) is unsafe, it cannot be the next edge in the MST (and C is already in the MST). (D, H) is also unsafe so it cannot be selected next. Thus, the next edge has to be (D, E). E is then removed from the queue.
So the next five edges that are selected by Prim's algorithm for the MST are:
(1). (F, G)
(2). (G, C)
(3). (F, A)
(4). (G, D)
(5). (D, E)